



Erebus Floating Wind

Appendix 19.2 Watercourse Crossing Schedule

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Author:	Kate Lucey
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ITPEnergised Office:	4th Floor, Centrum House, 108-114 Dundas Street, Edinburgh, UK, EH3 5DQ

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Appendix 19.2 Watercourse Crossing Schedule

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Figure 19.2.1 – Watercourse Crossing Locations

Introduction

This Watercourse Crossing Schedule has been produced to highlight the presence of watercourses which are required to be intersected by the proposed onshore export cable (Figure 19.2.1) and to provide relevant information on the nature of the crossings, likely crossing type required and design recommendations.

The basis of the Watercourse Crossing Schedule and recommendations is around the following design guidance:

- The Construction Industry Research and Information Association (CIRIA) Culvert, Screen and Operation Manual (CIRIA,2019);

The number of watercourse crossings required has been minimised as far as practicable possibly as part of the design evolution of the site, through focussed liaison within the project team. The proposed cable route generally follows the crest of high ground along the Angle Peninsula therefore minimising crossings of larger watercourses with greater contributing catchments.

Initially a desk-based assessment was undertaken, and watercourse crossings identified on OS waterlines have been assessed during the site walkover.

A hydrological site survey was conducted in May 2021 by an experienced Hydrologist. Most of the cable route was surveyed, where access would allow, and coordinated with the engineering design team. Additional crossings of minor watercourses (i.e. those not shown on OS mapping) and land drainage pathways have been identified. All crossings are required and unavoidable given the site setting and other site constraints.

The local hydrology of the site varies. The area is coastal and watercourses within the vicinity of the proposed cable route are generally fed by springs. There is no primary river basin catchment, rather the area is subdivided into numerous small surface water catchments which discharge directly to tidal headwaters.

There are no proposed crossings of designated “Main Rivers” therefore the proposed works are not subject to flood risk activity permits from Natural Resources Wales (NRW), however Ordinary Watercourse Consent will be sought from Pembrokeshire County Council (PCC).

Watercourse crossing methodologies

The watercourse crossing schedule below describes the solution for each additional crossing. For many of the surface water pathways, providing continuity of flow and suitable working environment during construction will suffice. This is likely to be in the form of open cut trench methodology. For more defined minor watercourses, Horizontal Directional Drilling methodology may be deployed.

Open cut trench

The majority of watercourse crossings will be carried out using dry open cut trench methodology. The water flow will be maintained by damming and, if necessary, over pumping or using temporary “flume” pipes installed in the bed of the watercourse.

- When using the temporary “flume” pipes in the bed of the watercourse, a suitably sized flume pipe is installed over the point of the proposed crossing. It must be ensured that it extends on each side of the watercourse to a distance at least equivalent to the depth of the proposed excavation. The flume pipe is then bedded and packed or surrounded with soil filled sandbags to create a seal or dam across the watercourse. A flume pipe bridge will have been installed, during the preparation of the working width, adjacent to the trench-line flume in order to enable passage of plant and materials along the cable route.

Excavation of the riverbed then proceeds beneath the trench-line flume pipe. The excavated riverbed material will be stored within the working area separately from the bank material. De-watering and/or trench supports may be used to facilitate safe excavation.

- If damming and over pumping methodology is adopted, then soil filled sandbags are still used to create a seal or dam across the watercourse. However, flume pumps are not installed in the riverbed but
-

adjacent to the river instead. The discharge hose will be directed through a filtering medium to limit silt carry over before the pumped water is allowed to percolate back into the watercourse.

The cable is then installed in the trench and checked to ensure that a minimum cover of 2 m (rivers) and 1.7 m (ditches) exists below the clean hard bed of the watercourse and the top of the cable. The cable may be protected by concrete protection slabs if appropriate.

Initial backfilling will take place using excavated subsoil free of large stones or other deleterious material. Final reinstatement will use the stored riverbed materials. The riverbanks are then reformed to their original profile to the satisfaction of both NRW and the landowner. Hard landscaping will be avoided where possible.

The flume pipe and packing or bags are removed once the bed materials and bank profile is reinstated. Final bank reinstatement may require further measures to stabilise the banks and prevent erosion. Geotextiles may be used in conjunction with seeding of an appropriate grass mix. Heavier solutions such as the importation of locally sourced large stones or rocks will only be used with NRW approval.

Horizontal Directional Drilling

Significant watercourses and obstacles will be crossed via Horizontal Directional Drilling (HDD). This is considered minimal-impact trenchless approach to install underground pipe.

With HDD, a pipeline is bored under the crossing to emerge at a target point on the opposite side. Location of the drill bit is monitored using the HDD locating system. An electronic transmitter in the drill head sends information to the locator operator's receiver.

Typically, each bore will accommodate a single circuit including the three power cables laid in trefoil and the fibre optic bundle. Therefore, separate drills will likely be required for each circuit crossing. Alternatively, subject to final Contractor specification, each power core of the circuit may require a separate bore and duct, likely laid in flat formation.

Watercourse Crossing Schedule

Watercourse Crossing 1 (WXC01)		
Location Description	Located on proposed export route between the boundary of agricultural fields to the east of South Studdock. Approximately 1.3km from the proposed landfall location.	 Looking downstream. Extremely dense vegetation and brambles obscuring channel.
Grid Co-ordinates	185812, 202073	
Watercourse Name	Unnamed watercourse identified during site walkover survey	
Watercourse Description	Minor watercourse or drainage channel set within relatively low gradient catchment flowing south to north. No running water heard at time of survey. Channel obscured by dense vegetation.	
Principal Watercourse Catchment	Castlemartin Corse - headwaters to tidal limit. Drains to tidal headwaters at Angle Bay	
Proposed Crossing Type(s)	Open cut trench methodology with over pumping if required	
Watercourse Crossing 2 (WXC02)		
Location Description	Located adjacent to agricultural fields to the north of WCX03	 Looking upstream. Channel located beneath line by soft (dark green) vegetation.
Grid Co-ordinates	187663, 201168	
Watercourse Description	Land drainage channel feeding into downstream watercourse and surface water pond. Dry at time of survey	
Principal Watercourse Catchment	Drains to adjacent watercourse (WCX03) surface water storage pond, and to final discharge at tidal headwaters to the south.	
Proposed Crossing Type(s)	Open cut trench methodology with over pumping if required	

Watercourse Crossing 3 (WXC03)			
Location Description	Located on unused land between agricultural fields	 Looking upstream. Channel located beneath line by soft (dark green) vegetation.	 Looking downstream towards discharge location at pond.
Grid Co-ordinates	187663, 201168		
Watercourse Name	Unnamed watercourse identified during site walkover survey		
Watercourse Description	Minor watercourse fed by field side drainage channels. Set within wide flat vegetated area with poorly defined channel. Possible that sub-channels exist during times of higher flow. Set within relatively low gradient catchment flowing north to south. Slow flow of water at time of survey.		
Principal Watercourse Catchment	Castlemartin Corse - headwaters to tidal limit Drains to surface water storage pond, and to final discharge at tidal headwaters to the south.		
Proposed Crossing Type(s)	Open cut trench methodology with over pumping		
Watercourse Crossing 4 (WXC04)			
Location Description	Located on between raised embankments at the boundary of agricultural fields land between agricultural fields 100m south of B4320	 View upstream towards B4320	 View downstream towards Gravel Bay
Grid Co-ordinates	188182, 201037		
Watercourse Name	Unnamed drainage channel identified during site walkover survey		
Watercourse Description	Minor field channel flowing north to south towards tidal headwaters at Gravel Bay. Dry at time of survey.		
Principal Watercourse Catchment	Castlemartin Corse - headwaters to tidal limit Final discharge at tidal headwaters to the south near Gravel Bay.		
Proposed Crossing Type(s)	Open cut trench methodology with over pumping		

Watercourse Crossing 5 (WXC05)		
Location Description	Located at the boundary of agricultural fields to the west of the B4319, adjacent to raised embankment between the channel and the road	
Grid Co-ordinates	188378, 200948	
Watercourse Name	Unnamed drainage channel identified during site walkover survey	
Watercourse Description	Minor field channel flowing north to south towards tidal headwaters at Gravel Bay. Standing water at time of survey – no flow.	
Principal Watercourse Catchment	Castlemartin Corse - headwaters to tidal limit Likely discharge at tidal headwaters to the south near Gravel Bay.	
Proposed Crossing Type(s)	HDD crossing is proposed for the road and should encompass the watercourse	
View upstream towards B4320		

Watercourse Crossing 6 (WXC06)		
Location Description	Located between agricultural fields and the B4319, to the east of the road	
Grid Co-ordinates	188395, 200940	
Watercourse Name	Unnamed drainage channel identified during site walkover survey	
Watercourse Description	Roadside drainage channel flowing north to south. Culverted under field access tracks. Some standing water at time of survey – no flow.	
Principal Watercourse Catchment	Castlemartin Corse - headwaters to tidal limit Likely discharge at tidal headwaters to the south near Gravel Bay.	
Proposed Crossing Type(s)	HDD crossing is proposed for the road and should encompass the watercourse	
View upstream towards B4320/ B3419 junction		

Watercourse Crossing 7 (WXC07)		
Location Description	Located within densely vegetated area adjacent to agricultural fields south east of Broomhill Farm	 View upstream looking downhill towards WXC07 – watercourse not visible beneath vegetation.
Grid Co-ordinates	188830, 201171	
Watercourse Name	Unnamed watercourse identified on OS 1:25k mapping	
Watercourse Description	Channel not visible beneath wide expanse of brambles. Viewed from upstream of crossing location due to access restrictions. Assumed minor watercourse flowing into surface water pond, visible on satellite imagery.	
Principal Watercourse Catchment	Angle Stream South - headwaters to tidal limit Drains from surface water pond to final discharge at tidal headwaters to the north.	
Proposed Crossing Type(s)	Open cut trench methodology with over pumping if required	
Watercourse Crossing 8 (WXC08)		
Location Description	Located within valley between agricultural fields south east of Broomhill Farm	 Valley of watercourse flowing south to north into pond viewed from accessible land upstream  Spring feeding the watercourse observed upstream from accessible location
Grid Co-ordinates	189261, 201284	
Watercourse Name	Unnamed watercourse identified on OS 1:25k mapping	
Watercourse Description	Channel not visible beneath curve of the valley. Viewed from upstream of crossing location due to access restrictions. Assumed minor watercourse flowing north to south into surface water pond, visible on satellite imagery. Spring location of the watercourse identified.	
Principal Watercourse Catchment	Angle Stream South - headwaters to tidal limit Drains from surface water ponds to final discharge at tidal headwaters to the north.	
Proposed Crossing Type(s)	Open cut trench methodology with over pumping	

Watercourse Crossing 9 (WXC09)		
Location Description	<i>Located running west to east through grassy field north of B3420</i>	 Outflow observed from culvert beneath rudimentary debris screening
Grid Co-ordinates	<i>189960, 201165</i>	
Watercourse Name	<i>Unnamed watercourse identified during site walkover</i>	
Watercourse Description	<i>Drainage culvert observed discharging to minor watercourse</i>	
Principal Watercourse Catchment	<i>Angle Stream South - headwaters to tidal limit</i> <i>Final discharge to tidal headwaters to the north west</i>	
Proposed Crossing Type(s)	<i>Open cut trench methodology with over pumping if required</i>	 Flow from culvert seen to connect to watercourse downstream
Watercourse Crossing 10 (WXC10)		
Location Description	<i>Located running south to north through agricultural fields</i>	 View upstream
Grid Co-ordinates	<i>189960, 201165</i>	
Watercourse Name	<i>Unnamed watercourse identified on OS 1:25k mapping</i>	
Watercourse Description	<i>Minor watercourse observed flowing south to north to discharge finally at tidal headwaters. 3cm deep, bed width 0.5m, bank width 1.5/2m. Silty/sandy bed with rocks and shingle lining the banks</i>	
Principal Watercourse Catchment	<i>Angle Stream South - headwaters to tidal limit</i> <i>Final discharge to tidal headwaters to the north west</i>	
Proposed Crossing Type(s)	<i>Open cut trench methodology with over pumping</i>	

Watercourse Crossing 11 (WXC11)		
Location Description	Located running south to north through agricultural fields	
Grid Co-ordinates	190208, 200975	
Watercourse Name	Unnamed watercourse identified on OS 1:25k mapping	
Watercourse Description	Watercourse located within a wide area covered in soft vegetation and trees. Channel not visible due to soft vegetation, however running water heard. Width between banks estimated to be 10m or greater therefore possible that subchannels may be present. Land drains observed discharging into WC either via culvert (not visible) or direct runoff	
Principal Watercourse Catchment	Angle Stream South - headwaters to tidal limit Drains to surface water pond then to final discharge at tidal headwaters to the north east.	
Proposed Crossing Type(s)	This watercourse is to be cross via HDD	
Watercourse Crossing 12 (WXC12)		
Location Description	Located running south east to north west through agricultural fields between Wogaston and Wallaston Green	
Grid Co-ordinates	192018, 200490	
Watercourse Name	Unnamed watercourse identified on OS 1:25k mapping	
Watercourse Description	Minor watercourse with approx. 1m wide channel, adjacent to raised wooded verge with secondary channel on other side. Discharges to nearby pond.	
Principal Watercourse Catchment	Angle Stream South - headwaters to tidal limit Enters series of surface water ponds before final discharge at tidal headwaters to the north east.	
Proposed Crossing Type(s)	Open cut trench methodology with over pumping	

View from western bank looking slightly downstream. Tall trees can be seen within the channel area.

View upstream from raised embankment

Watercourse Crossing 13 (WXC13)			
Location Description	Located running south east to north west through agricultural fields between Wogaston and Wallaston Green	 Vegetated watercourse channel	 View upstream – wooded raised bank visible on western bank
Grid Co-ordinates	192022, 200490		
Watercourse Name	Unnamed watercourse identified on OS 1:25k mapping		
Watercourse Description	Minor watercourse with channel width of approximately 2m located, adjacent to reeded habitat and raised wooded verge with secondary channel on other side. Flows north east to south west before discharging to nearby pond.		
Principal Watercourse Catchment	Angle Stream South - headwaters to tidal limit Enters series of surface water ponds before final discharge at tidal headwaters to the north east.		
Proposed Crossing Type(s)	Open cut trench methodology with over pumping		
Watercourse Crossing 14 (WXC14)			
Location Description	Located running east to west through agricultural fields between Wogaston and Wallaston Green	 View upstream	
Grid Co-ordinates	192143, 200686		
Watercourse Name	Unnamed watercourse identified during site survey		
Watercourse Description	Shallow channel minor watercourse observed to be culverted under field access. Presumed spring fed as water is running at time of survey despite dry conditions. Appears to converge with WC15 slightly downstream of the crossing		
Principal Watercourse Catchment	Angle Stream South - headwaters to tidal limit Enters series of surface water ponds before final discharge at tidal headwaters to the north east.		
Proposed Crossing Type(s)	Open cut trench methodology with over pumping		

Watercourse Crossing 15 (WXC15)			
Location Description	Located running east to west through agricultural fields between Wogaston and Wallaston Green	 View upstream	 View downstream, channel obscured by vegetation
Grid Co-ordinates	192147, 200693		
Watercourse Name	Unnamed watercourse identified during site survey		
Watercourse Description	Minor watercourse with channel width of approx. 1m. Observed to be culverted under field access. Presumed spring fed as water is running at time of survey despite dry conditions. Appears to converge with WC14 slightly downstream of the crossing		
Principal Watercourse Catchment	Angle Stream South - headwaters to tidal limit Enters series of surface water ponds before final discharge at tidal headwaters to the north east.		
Proposed Crossing Type(s)	Open cut trench methodology with over pumping		
Watercourse Crossing 16 (WXC16)			
Location Description	Located running east to west immediately adjacent to exiting industrial area before discharging to tidal headwaters downstream of the Pembroke River	No access for photo	
Grid Co-ordinates	193554, 202274		
Watercourse Name	Unnamed watercourse identified on OS 1:25k mapping		
Watercourse Description	Unable to access channel due to access restrictions.		
Principal Watercourse Catchment	Green Hill Stream - headwaters to tidal limit Final discharge to tidal headwaters to the north east		
Proposed Crossing Type(s)	Open cut trench methodology with over pumping		

Conclusions and Recommendations

This Watercourse Crossing Schedule has been produced to highlight the presence of watercourses which are required to be intersected by the proposed onshore export cable. It provides relevant information on the nature of the crossings, likely crossing type required and design recommendations.

Ultimately, the recommendations set out in the Watercourse Crossing Schedule are compliant with best practice design guidance and proportionate to the hydrological regimes encountered during the site survey.

Following planning permission, the Watercourse Crossings will be subject to authorisation and Ordinary Watercourse consent from Pembrokeshire County Council. All engineering activities authorised under ordinary watercourse consent will be carried out in accordance with good practice and in compliance with environmental standards.

Drawings



- KEY**
- Onshore Consent Boundary
 - Watercourse Crossing
 - Watercourses

0 0.9 1.8 km
Scale 1:34,985 @ A3



Project Erebus
Environmental Statement

Figure 19.2.1
Watercourse Crossing Locations

Geodetic Parameters: British National Grid
Date: 22/11/2021 Drawn by: KL Checked by: SD Version: V1

References

Construction Industry Research and Information Association (2019). Culvert, screen and outfall manual (C786).
Available at: <https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocID=328474>